CEPT/ERC/RECOMMENDATION 12-09 (The Hague 1998)

RADIO FREQUENCY CHANNEL ARRANGEMENT FOR FIXED SERVICE SYSTEMS OPERATING IN THE BAND 57.0 – 59.0 GHz WHICH DO NOT REQUIRE FREQUENCY PLANNING

Recommendation proposed by the Working Group "Spectrum Engineering" (WGSE)

Text of the Recommendation adopted by the "European Radiocommunications Committee" (ERC):

"The European Conference of Postal and Telecommunications Administrations,

considering

1) that CEPT should develop radio frequency channel arrangements in consultation with organisations developing standards for radio systems, in order to make the most effective use of the spectrum available;

2) that the propagation characteristics of the 57.0 – 59.0 GHz are ideally suited for use of short range radio links in high density networks;

3) that the high frequency reuse achievable in the oxygen absorption band reduces the requirement for frequency planning techniques and offers the possibility of deregulated telecommunications environment within CEPT for various low power, low cost and short range radio-relays;

4) that the uses envisaged in this band include digital and analogue systems;

5) that a number of new and existing systems could operate adequately on an unprotected basis in the range of 57.0 – 59.0 GHz, relieving congestion in the lower frequency bands,

noting

a) that Radio Regulations allocate the band 57.0 – 58.2 GHz on a primary basis for Earth Exploration Satellite (passive), Fixed, Inter-Satellite, Mobile and Space Research services, and 58.2 – 59.0 GHz on a primary basis for Earth Exploration Satellite (passive), Fixed, Mobile and Space Research (passive) services;

b) that in the frequency range of 57.0 – 59.0 GHz oxygen gas absorption attenuation is more than 10 dB/km at sea level;

c) that the high attenuation effectively limits the achievable path length and interference level;

d) that in the frequency range 57.0 – 59.0 GHz high antenna directivity is achievable even with small size antennas, further reducing the risk of co-channel interference;

e) that equipment may listen for a free channel before transmission to recognise existing transmissions in order to minimise interference problems and to ensure continued operation of existing transmissions.

recommends

1) that the equipment operating in this frequency range should have only minimum restrictions for future technical enhancements, but the necessary requirements to ensure reliable operation;

2) that the CEPT Administrations should follow the recommended channel arrangements for the frequency range 57.0 – 59.0 GHz given in **Annex A, Table 1** and **Table 2**;

3) that channels within the frequency ranges 57.0 - 57.100 GHz and 58.900 – 59.0 GHz should not be used for traffic, until satisfactory coexistence studies with Fixed Service in adjacent bands are completed; these channels could be used for equipment alignment and propagation tests;

4) that the EIRP should be limited to +15 dBW;

5) that the maximum allowable radio frequency tolerance should not exceed ±50 ppm.

ANNEX A

RADIO-FREQUENCY CHANNEL ARRANGEMENTS IN THE BAND 57.0 – 59.0 GHz

Let f_r be the reference frequency of 56 950 MHz,
f_n be the centre frequency of a radio-frequency channel in the band 57.0 – 59.0 GHz,

then the centre frequencies of individual channels are expressed by the following relationships:

a) for systems with a channel separation of 100 MHz:

$$f_n = f_r + 100\ n \quad \text{MHz}$$

where:

n = 1, 2, 3, ...20

b) for systems with a channel separation of 50 MHz:

$$f_n = f_r + 25 + 50\ n \quad \text{MHz}$$

where:

n = 1, 2, 3, ...40

Calculated parameters according to ITU-R Rec. 746

TABLE 1

XS MHz	n	f1 MHz	fn MHz	Z1S MHz	Z2S MHz
50	1,...40	57025	58975	25	25
100	1,...20	57050	58950	50	50

XS Separation between centre frequencies of adjacent channels

Z1S Separation between the lower band edge and the centre frequency of the first channel

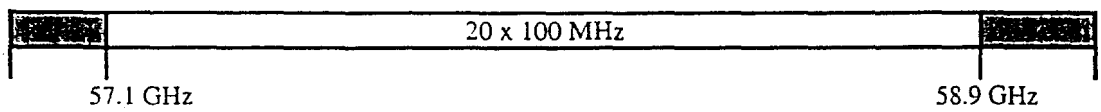
Z2S Separation between centre frequencies of the final channel and the upper band edge

Occupied spectrum: 57 to 59 GHz Band

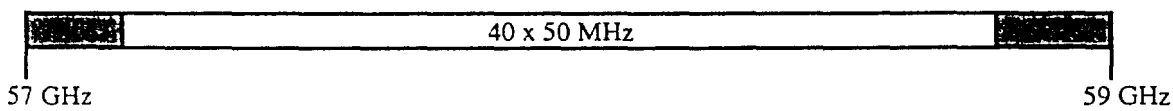
Figure 1

a) 100 MHz channels

*)



b) 50 MHz channels



*) Channels referred to in recommends 3

RESOLUTION 726 (WRC-97)

Frequency bands above 30 GHz available for high-density applications in the fixed service

The World Radiocommunication Conference (Geneva, 1997),

considering

a) that there is a dramatically increasing demand for high-density applications in the fixed service resulting from the deployment of new mobile networks and from the rapid worldwide deregulation in the provision of local broadband services, including multimedia;

b) that the frequency range from 30 GHz to about 50 GHz is the range preferred to satisfy initial requirements, as indicated in *considering a)*, while the bands above about 50 GHz are preferred for similar applications but which take technical advantage of high atmospheric absorption;

c) that the lower part of the spectrum above 30 GHz has advantages for the fixed service in areas where longer path lengths are necessary;

d) that the 38 GHz band is already heavily used by many administrations for high-density applications in the fixed service;

e) that the needs of other services to which the relevant frequency bands are already allocated must be taken into account;

f) that the band 37-37.5 GHz is being planned for use by the space research service (space-to-Earth) to provide moon-to-Earth and planetary communication links;

g) that the band 37-38 GHz is being planned for use by the space research service to provide space based very long baseline interferometry;

h) that the deployment of high-density applications in the fixed service in some bands potentially presents sharing difficulties with other primary services allocated to the same band, e.g. the fixed-satellite service;

i) that operations in the space services, such as in the fixed-satellite service, in those bands used by high-density applications in the fixed service may lead to sharing difficulties;

j) that there is a need for global harmonization of new and existing allocations of radio frequency bands to facilitate coordination between administrations and encourage development of competitive products, through economies of scale, and the worldwide introduction of new telecommunication services, including the provision of reliable global information infrastructure access at an affordable cost,

resolves

that administrations should take into account that the bands 31.8-33.4 GHz*, 51.4-52.6 GHz, 55.78-59 GHz and 64-66 GHz are available for high-density applications in the fixed service, when considering allocations or other regulatory provisions in relation to these bands,

requests ITU-R

1 to undertake studies leading to the identification of system characteristics of high-density systems in the fixed service in the bands listed in the *resolves*;

2 to undertake, as a matter of urgency, studies of technical and operational criteria and of methods to facilitate sharing between high-density systems in the fixed service and other services in the bands listed in the *resolves*,

urges administrations

to participate actively in the aforementioned studies by submitting contributions to ITU-R.

* The date of provisional application of this allocation shall be in conformity with Resolution 126 (WRC-97).

55.78-66 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
55.78-56.9	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.556A MOBILE S5.558 SPACE RESEARCH (passive) S5.547 S5.557	
56.9-57	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.558A MOBILE S5.558 SPACE RESEARCH (passive) S5.547 S5.557	
57-58.2	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.556A MOBILE S5.558 SPACE RESEARCH (passive) S5.547 S5.557	
58.2-59	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) S5.547 S5.556	
59-59.3	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.556A MOBILE S5.558 RADIOLOCATION S5.559 SPACE RESEARCH (passive)	
59.3-64	FIXED INTER-SATELLITE MOBILE S5.558 RADIOLOCATION S5.559 S5.138	
64-65	FIXED INTER-SATELLITE MOBILE except aeronautical mobile S5.547 S5.556	
65-66	EARTH EXPLORATION-SATELLITE FIXED INTER-SATELLITE MOBILE except aeronautical mobile SPACE RESEARCH S5.547	

S5.543 The band 29.95-30 GHz may be used for space-to-space links in the Earth exploration-satellite service for telemetry, tracking, and control purposes, on a secondary basis.

S5.544 In the band 31-31.3 GHz the power flux-density limits specified in Article S21, Table S21-4 shall apply to the space research service.

S5.545 *Different category of service:* in Armenia, Azerbaijan, Belarus, Bulgaria, Georgia, Kazakstan, Mongolia, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan and Ukraine, the allocation of the band 31-31.3 GHz to the space research service is on a primary basis (see No. S5.33). (WRC-97)

S5.546 *Different category of service:* in Saudi Arabia, Armenia, Azerbaijan, Belarus, Bulgaria, Egypt, United Arab Emirates, Spain, Estonia, Finland, Georgia, Hungary, the Islamic Republic of Iran, Israel, Jordan, Kazakstan, Latvia, Lebanon, Moldova, Mongolia, Uzbekistan, Poland, Syria, Kyrgyzstan, Romania, the United Kingdom, Russian Federation, Tajikistan, Turkmenistan, Turkey and Ukraine, the allocation of the band 31.5-31.8 GHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. S5.33). (WRC-97)

S5.547 The bands 31.8-33.4 GHz, 51.4-52.6 GHz, 55.78-59 GHz and 64-66 GHz are available for high-density applications in the fixed service (see Resolution **726 (WRC-97)**). (WRC-97)

S5.547A Use of the band 31.8-33.4 GHz by the fixed service shall be in accordance with Resolution **126 (WRC-97)**. (WRC-97)

S5.547B *Alternative allocation*: in the United States, the band 31.8-32 GHz is allocated to the radionavigation and space research (deep space) (space-to-Earth) services on a primary basis. (WRC-97)

S5.547C *Alternative allocation*: in the United States, the band 32-32.3 GHz is allocated to the inter-satellite, radionavigation and space research (deep space) (space-to-Earth) services on a primary basis. (WRC-97)

S5.547D *Alternative allocation*: in the United States, the band 32.3-33 GHz is allocated to the inter-satellite and radionavigation services on a primary basis. (WRC-97)

S5.547E *Alternative allocation*: in the United States, the band 33-33.4 GHz is allocated to the radionavigation service on a primary basis. (WRC-97)

S5.548 In designing systems for the inter-satellite and radionavigation services in the band 32-33 GHz, and for the space research service (deep space) in the band 31.8-32.3 GHz, administrations shall take all necessary measures to prevent harmful interference between these services, bearing in mind the safety aspects of the radionavigation service (see Recommendation **707**).

S5.549 *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Egypt, the United Arab Emirates, Gabon, Indonesia, the Islamic Republic of Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malaysia, Mali, Malta, Morocco, Mauritania, Nepal, Nigeria, Oman, Pakistan, the Philippines, Qatar, Dem. Rep. of the Congo, Syria, Senegal, Singapore, Somalia, Sudan, Sri Lanka, Togo, Tunisia and Yemen, the band 33.4-36 GHz is also allocated to the fixed and mobile services on a primary basis. (WRC-97)

S5.557 *Additional allocation:* in Japan, the band 55.78-58.2 GHz is also allocated to the radiolocation service on a primary basis. (WRC-97)

S5.558 In the bands 55.78-58.2 GHz, 59-64 GHz, 66-71 GHz, 116-134 GHz, 170-182 GHz and 185-190 GHz, stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**). (WRC-97)

S5.558A Use of the band 56.9-57 GHz by inter-satellite systems is limited to links between satellites in geostationary-satellite orbit and to transmissions from non-geostationary satellites in high-Earth orbit to those in low-Earth orbit. For links between satellites in the geostationary-satellite orbit, the single entry power flux-density at all altitudes from 0 km to 1 000 km above the Earth's surface, for all conditions and for all methods of modulation, shall not exceed -147 dB(W/m^2/100 MHz) for all angles of arrival. (WRC-97)

S5.559 In the bands 59-64 GHz and 126-134 GHz, airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**).

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

(unofficial document)
Document R9B/TEMP/102
11 November 1999
Original: English only

Source: Documents 9B/112 and 9B/123

DRAFT NEW RECOMMENDATION F.[9B/57 GHz]

RADIO-FREQUENCY CHANNEL ARRANGEMENTS FOR SYSTEMS IN THE FIXED SERVICE IN THE BAND 55.78 - 59 GHz

(Question ITU-R 108/9)

(1999)

The ITU Radiocommunication Assembly,

considering

a) that the band 55.78 - 58.2 GHz is allocated to the Earth exploration satellite (passive), fixed, inter-satellite, mobile and space research (passive) services on a primary basis and the band 58.2 - 59.0 GHz is allocated to the Earth exploration satellite (passive), fixed, mobile and space research (passive) services on a primary basis;

b) that footnote S5.547 identifies the 55.78 - 59.0 GHz band as being available for high-density applications in the fixed service;

c) that ITU-R should develop radio-frequency channel arrangements in order to make the most effective use of the spectrum available;

d) that the propagation characteristics of the 55.78 - 59.0 GHz band are ideally suited for use of short range digital radio links in high-density networks;

e) that in the frequency range a high antenna directivity is achievable even with small size antennas, increasing the density of equipment and further reducing risk of interference with same and other services;

f) that differing applications licensed by various administrations may require different radio-frequency channel arrangements;

g) that the applications in this frequency band may require differing channel bandwidths;

h) that several services with various transmission signal characteristics and capacities may be in simultaneous use in this frequency band;

j) that a high degree of compatibility between radio-frequency channels of different arrangements can be achieved by selecting channel centre frequencies within a homogeneous basic pattern;

k) that the low end of the frequency band is suitable for the longest hop radio links because the atmospheric attenuation is less than at the top of the band;

l) that the high frequency reuse achievable due to oxygen absorption in the upper portion of the band reduces the requirement for frequency planning techniques and offers the possibility of deregulated telecommunications environments for various low-power, low-cost and short-range radio-relays;

m) that a number of new and existing systems could operate adequately on an unprotected basis in the upper portion of the band, relieving congestion in the lower frequency bands;

n) that the uses envisaged in this band include digital and analogue systems,

noting

i) that FDD (frequency division duplex) and TDD (time division duplex) systems may be used simultaneously in the same geographical area providing sufficient measures are put in place to allow successful coordination;

ii) that in the upper portion of the frequency range 55.78 - 59.0 GHz oxygen gas absorption attenuation is more than 10 dB/km at sea level;

iii) that the high attenuation effectively limits the achievable path length and interference level;

iv) that equipment may listen for a free channel before transmission to recognize existing transmissions in order to minimize interference problems and to ensure continued operation of existing transmissions;

v) that Recommendation ITU-R F.1100 "Radio-Frequency Channel Arrangements for Radio-Relay Systems in the 55 GHz Band" is now out of date following the re-allocation of services within the 50 - 70 GHz range following WRC-97,

recommends

1 that administrations consider the channel arrangement given in Annex 1, section 1, for time division duplex (TDD) FS system deployment in the frequency range 55.78 - 57.0 GHz (see NOTE 1);

2 that administrations consider the channel arrangement given in Annex 1, section 2, for frequency division duplex (FDD) FS system deployment in the frequency range 55.78 - 57.0 GHz (see NOTE 1);

3 that administrations consider the channel arrangement given in Annex 2 for FS system deployment in the frequency range 57 - 59 GHz (see NOTE 2);

NOTE 1 - The channel arrangements in Annex 1 provide the same centre frequencies for both TDD and FDD operation.

NOTE 2 - Due consideration should be given in the use of the channels at the upper and lower edges of the frequency band 57 - 59 GHz to ensure compatibility with fixed systems operating in the adjacent bands.

ANNEX 1

Radio-frequency channel arrangement in the band 55.78 - 57.0 GHz

1 Fixed service systems using TDD operation

Let f_r be the reference frequency of 55 786 MHz,

f_n be the centre frequency of a radio-frequency channel in the band 55.78 - 57.0 GHz,

then the centre frequencies of individual channels are expressed by the following relationships:

a) for systems with a channel separation of 56 MHz:

$$f_n = f_r + 28 + 56\ n \quad \text{MHz}$$

where:

n = 1, 2, 3, ...20

b) for systems with a channel separation of 28 MHz:

$$f_n = f_r + 42 + 28\ n \quad \text{MHz}$$

where:

n = 1, 2, 3, ...40

c) for systems with a channel separation of 14 MHz:

$$f_n = f_r + 49 + 14\ n \quad \text{MHz}$$

where:

n = 1, 2, 3, ...80

TABLE 1

Calculated parameters according to Recommendation ITU-R F.746

XS MHz	n	f_1 MHz	f_n MHz	Z1S MHz	Z2S MHz
56	1,...20	55 870	56 934	90	66
28	1,...40	55 856	56 948	76	52
14	1,...80	55 849	56 955	69	45

XS Separation between centre frequencies of adjacent channels.

Z1S Separation between the lower band edge and the centre frequency of the first channel.

Z2S Separation between centre frequencies of the final channel and the upper band edge.

2 Fixed service systems using FDD operation

The radio-frequency channel arrangement for channel separations of 56 MHz, 28 MHz and 14 MHz shall be derived as follows:

Let f_r be the reference frequency of 55 814 MHz,

f_n be the centre frequency (MHz) of the radio-frequency channel in the lower half of the band,

f'_n be the centre frequency (MHz) of the radio-frequency channel in the upper half of the band,

TX/RX separation = 616 MHz

Band separation = 112 MHz

then the frequencies (MHz) of individual channels are expressed by the following relationships:

a) for systems with a channel separation of 56 MHz:

lower half of the band: $f_n = f_r + 56\ n$

upper half of the band: $f'_n = f_r + 616 + 56\ n$ where n = 1,2, ... 9

b) for systems with a channel separation of 28 MHz:

lower half of the band: $f_n = f_r + 14 + 28\ n$

upper half of the band: $f'_n = f_r + 630 + 28\ n$ where n = 1, 2, 3, ... 18

c) for systems with a channel separation of 14 MHz:

lower half of the band: $f_n = f_r + 21 + 14\ n$

upper half of the band: $f'_n = f_r + 637 + 14\ n$ where n = 1, 2, 3, ... 36

TABLE 2

Calculated parameters according to Recommendation ITU-R F.746

XS MHz	n	f_1 MHz	f_n MHz	f_1 MHz	f'_n MHz	Z1S MHz	Z2S MHz	YS MHz	DS MHz
56	1,...9	55 870	56 318	56 486	56 934	90	66	168	616
28	1,...18	55 856	56 332	56 472	56 948	76	52	140	616
14	1,...36	55 849	56 339	56 465	56 955	69	45	126	616

XS Separation between centre frequencies of adjacent channels.

YS Separation between centre frequencies of the closest go and return channels.

Z1S Separation between the lower band edge and the centre frequency of the first channel.

Z2S Separation between centre frequencies of the final channel and the upper band edge.

DS Duplex spacing ($f'_n - f_n$).

TABLE 3

Calculated parameters according to Recommendation ITU-R F.746

XS MHz	n	f_1 MHz	f_n MHz	Z1S MHz	Z2S MHz
50	1,...40	57 025	58 975	25	25
100	1,...20	57 050	58 950	50	50

XS Separation between centre frequencies of adjacent channels.

Z1S Separation between the lower band edge and the centre frequency of the first channel.

Z2S Separation between centre frequencies of the final channel and the upper band edge.

ANNEX 2

RADIO-FREQUENCY CHANNEL ARRANGEMENTS IN THE BAND 57.0 – 59.0 GHz

Let f_r be the reference frequency of 56 950 MHz,

f_n be the centre frequency of a radio-frequency channel in the band 57.0 – 59.0 GHz,

then the centre frequencies of individual channels are expressed by the following relationships:

a) for systems with a channel separation of 100 MHz:

$$f_n = f_r + 100\,n \quad \text{MHz}$$

where:

n = 1, 2, 3, ...20

b) for systems with a channel separation of 50 MHz:

$$f_n = f_r + 25 + 50\,n \quad \text{MHz}$$

where:

n = 1, 2, 3, ...40

XS MHz	n	f1 MHz	fn MHz	Z1S MHz	Z2S MHz
50	1,...40	57025	58975	25	25
100	1,...20	57050	58950	50	50

TABLE 1

Calculated parameters according to ITU-R Rec. 746

XS Separation between centre frequencies of adjacent channels

Z1S Separation between the lower band edge and the centre frequency of the first channel

Z2S Separation between centre frequencies of the final channel and the upper band edge

EN 300 408 TM4(99) 22_02 Annex 4

European Standard (Telecommunications series)

Fixed Radio Systems; Point-to-point equipment; Parameters for Radio Systems for the transmission of digital signals and analogue video signals operating at around 58 GHz, which do not require co-ordinated frequency planning

Reference: REN/TM-04072

European Telecommunications Standards Institute

Reference
REN/TM 04072

Keywords
Analogue, digital, DRRS, transmission, video

ETSI Secretariat

Postal address
F-06921 Sophia Antipolis Cedex - FRANCE

Office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la Sous-Préfecture de Grasse (06) N° 7803/88

X.400
c= fr; a=atlas; p=etsi; s=secretariat

Internet
secretariat@etsi.fr
http://www.etsi.fr

Contents

Intellectual Property Rights 5
Foreword 5
1 Scope 6
2 References 7
3 Symbols and abbreviations 8
3.1 Symbols 8
3.2 Abbreviations 8
4 General characteristics 9
4.1 Frequency bands and channel arrangements 9
4.1.1 Frequency band 9
4.1.2 Radio Channel Arrangements 9
4.1.3 RF-channel Selection 9
4.1.4 Transmit/receive frequency separation 10
4.2 Environmental Conditions 10
4.2.1 Equipment within weather protected locations (indoor locations) 11
4.2.2 Equipment for non-weather protected locations (outdoor locations) 11
4.3 Electromagnetic Compatibility 11
4.4 Baseband Interface 11
4.5 System block diagram 11
4.6 Antennas and RF-interface 12
4.6.1 Antenna Requirements 12
4.6.2 RF interface 12
4.7 Power supply 12
5 Parameters for digital systems 13
5.1 Transmission capacity 13
5.2 Error-performance and availability requirements for Class A equipment 13
5.3 Transmitter characteristics 13
5.3.1 Transmitter power 13
5.3.2 Radiated Spectrum 14
5.3.3 Radio frequency tolerance 14
5.4 Receiver characteristics 14
5.4.1 Spurious emissions 14
6. Parameters for wideband analogue systems 16
6.1 Transmitter characteristics 16
6.1.1 Power 16
6.1.2 Radiated spectrum 16
6.1.3 RF frequency tolerance 16

6.2 Receiver characteristics, spurious emissions 16
Annex A (informative): Additional information 18
A.1 Additional information on Class A and Class B 18
A.2 Radio frequency channel arrangement 18
A.3 Antenna alignment procedures 19
Annex B (Normative): Essential requirements for the EC Council Directive 89/336 (EMC Directive) 20
Annex C (normative): System type codes for regulatory procedures 21
Annex D (informative): Rationale for the interference limit formula 22
D.1 Analysis of the quality value for the channel selection procedure 22
D.1.1 Theoretical background 22
D.1.2 Analysis of a typical co-channel interference situation when channel rejection threshold is used 22
D.2 Protection capability of the RF-channel selection procedure 24
D.3. Frequency agility criteria 24
History 25

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETR 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available **free of charge** from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://www.etsi.fr/ipr).

Pursuant to the ETSI Interim IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETR 314 (or the updates on http://www.etsi.fr/ipr) which are, or may be, or may become, essential to the present document.

Foreword

This European Standard (Telecommunication series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM).

The present document, together with EN 300 385 is intended to become a Harmonised Standard, the reference of which is intended to be published in the Official Journal of the European Communities, referencing Council Directive 89/336/EEC (EMC Directive).

1 Scope

The present document specifies the minimum performance requirements for terrestrial fixed service radiocommunications equipment operating in the 58 GHz frequency band which do not require co-ordinated frequency planning.

The frequency band is proposed to be used by various technologies for uncoordinated use of the band. It also benefits from the high and stable atmospheric attenuation which suppresses efficiently distant interferers (about 10 to 15 dB/km at sea level, refer to ITU-R P.676 [18]).

For the purposes of this standard two equipment classes are specified depending on the network requirements:

Class A: Digital equipment for High Density Fixed Service (HDFS) applications typically connected to public networks, which apply the RF-channel selection procedure (see Clause 4.1.3), error performance and availability requirements (see Clause 5.2).

Class B: Equipment without requirements for quality of service, typically private network connections.

Typical applications for Class A equipment are e.g. interconnection between cellular networks where there, in some cases, is a need for short length connections (up to about 500 meters). The RF channel selection procedure shall be used to protect existing systems from a new system being commissioned. However, the channel selection procedure may not guarantee interference free installation or operation in all cases due to limitations in the procedure with respect to the variety of systems.

Typical applications for Class B equipment are in private networks, such as video surveillance systems.

The present document does not contain aspects related to test procedures and test conditions, however they are to be found in EN 301 126-1 [6].

Safety aspects are outside the mandate of ETSI and they will not be considered in this EN. However compliance to CENELEC EN 60950 will be required to comply with 99/5/EC Directive (R&TTE).

Technical background for the parameters and requirements referred in this EN may be found in TR 101036-1 [17].

2 References

References may be made to

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

In the case of undated references, the time frame of application and new certification procedures for new releases of these normative references after the date of the first public enquiry of the present document or the first certification of the equipment shall be agreed between the supplier and the regulatory authority. These new certification procedures will cover in any case only the parameters subject to changes from the on going release during the previous certification.

[1] ETS 300 132-1: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment Part 1: Interfaces operated by alternating current (AC)"

[2] ETS 300 132-2: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment Part 2: Interfaces operated by direct current (DC)".

[3] ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".

[4] EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment."

[5] CEPT/ERC Recommendation 12-09: "Radio Frequency Channel Arrangement for Fixed Service Systems Operating in the Band 57-59 GHz which do not Require Frequency Planning"

[6] EN 301 126-1 "Transmission and Multiplexing (TM); Conformance Testing for Digital Radio Relay Systems (DRRS); Part 1: Point –to-point equipment parameters".

[7] ITU-R F.ANPER: "Availability objectives for real digital radio-relay links forming part of the national portion constant bit rate digital path at or above the primary rate"

[8] ITU-T Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".

[9] CEPT/ERC Recommendation 74-01 "Spurious Emissions"

[10] ITU-R Recommendation F.1191: "Bandwidths and unwanted emissions of digital radio relay systems"

[11] ITU-T Recommendation G.826: "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".

[12] ITU-R Recommendation F.1189: "Error-performance objectives for constant bit rate digital paths at or above the primary rate carried by digital radio-relay systems which may form part or all of the national portion of a 27 500 km hypothetical reference path".

[13] ITU-R Recommendation P.530: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".

[14] ITU-R Recommendation F.1102: "Characteristics of radio-relay systems operating in frequency bands above about 17 GHz".

[15] prETS 300 833 (1999): "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Antennas used in point-to-point DRRS operating in the frequency band 3 to 60 GHz"

[16] ITU-R F.697: "Error-performance and availability objectives for the local-grade portion at each end of an integrated services digital network connection at a bit rate below the primary rate utilising digital radio-relay systems"

[17] TR 101 036-1: "Transmission and Multiplexing (TM); Generic wordings for standards on Digital Radio Relay Systems characteristics; Part 1; General aspects and point-to-point equipment parameters.

[18] ITU-R Recommendation P.676: "Attenuation by atmospheric gases"

3 Symbols and abbreviations

3.1 Symbols

For the purposes of the present document, the following symbols apply:

dB	decibel
dBi	decibel relative to an isotropic radiator
dBm	decibel relative to 1 milliWatt
dBW	decibel relative to 1 Watt
GHz	GigaHertz
MHz	MegaHertz
kHz	kiloHertz
km	kilometre
Mbit/s	Mega-bits per second
ppm	parts per million
V	volts

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternating current
AGC	Automatic Gain Control
BER	Bit Error Ratio
BW	Equivalent noise bandwidth
CENELEC	European Committee for Electrotechnical Standardization
CEPT	Conférence des Administrations Européennes des Postes et Télécommunications
DC	direct current
CW	Continuous Wave
DRRS	Digital Radio Relay Systems
EIRP	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EN	Euronorm
ERC	European Radiocommunications Committee

ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FDD	Frequency Division Duplex
HDFS	High Density Fixed Service
IEC	International Electrotechnical Commission
ITU-R	International Telecommunication Union - Radiocommunication sector
ITU-T	International Telecommunication Union - Telecommunications standardization sector
PDH	Plesiochronous Digital Hierarchy
Pi	Interference Power
PTX	Transmit Power
RES	Radio Equipment and Systems (ETSI Technical Committee)
RF	Radio Frequency
TDD	Time Division Duplex
TM	ETSI TC-Transmission and Multiplexing

4 General characteristics

4.1 Frequency bands and channel arrangements

4.1.1 Frequency band

The frequency band is from 57 GHz to 59 GHz.

Note: The successful co-existence of Class A and Class B equipment may require the regulator to define exclusive spectrum for each equipment class (see Annex A).

4.1.2 Radio Channel Arrangements

The channel arrangements are specified in CEPT/ERC REC T/R 12-09 [5] with 50 MHz or 100 MHz channel rasters. For reader convenience, the basic parameters of the CEPT Recommendation are shown in informative Annex A.

4.1.3 RF-channel Selection

RF-channel selection procedure is mandatory for Class A equipment only.

4.1.3.1 RF-channel selection procedure

The purpose of the RF-channel selection procedure is to detect and protect existing transmissions in order to avoid unacceptable interference situations.

At both transmission sites, radio-relay terminals shall measure during installation, the interference levels of both receive and transmit channels (Note). Only in the instance when an unoccupied channel is identified and selected as the transmission channel shall the transmit power be switched on. The interference avoidance requirements for the receiver to detect occupied channels are specified in Clause 4.1.3.2 below.

The principle of protecting existing transmission shall be respected also during the antenna alignment (see informative Annex A for examples of possible antenna alignment procedures)

Note: If the national regulatory rules allowes to change the frequency of the link during its operation, it may be considered, in order to decrease the possibility of undetected interference, to apply the RF channel selection procedure whenever appropriate (e.g. when restoring a link after a failure or by suitable automatic timed routine in conjunction with frequency agility as in clause 4.1.3.3).

4.1.3.2 Interference avoidance requirements

4.1.3.2.1 Interference avoidance limit

The radio relay terminal shall consider the radio channel occupied when the level of the interference is above the following limit:

$Pi > -81$ dBm + 10 log (BW/10 MHz)

Where:
BW is the noise bandwidth of the receiver expressed in MHz.
Pi is the interference power expressed in dBm measured within the receiver noise bandwidth (BW).

For the rationale of the interference limit formula see informative Annex D.

4.1.3.2.2. Interference avoidance limit calibration

The interference avoidance limit of the radio relay terminal shall be calibrated with the CW test signal connected to the reference point D (antenna port) of the terminal at any frequency within the receiver noise bandwidth or at any frequency within the transmitter spectrum limits, containing 90% of the transmit power,.

4.1.3.3 Frequency agility

Frequency agility is an optional feature.

If unacceptable interference which exceeds a predetermined duration is observed an automatic change of RF-channel can be initiated using the RF-channel selection procedure described above. If an automatic RF-channel change facility is implemented a means shall be provided to disable it. Unacceptable interference criteria shall be declared by the manufacturer (see informative Annex D.3).

4.1.4 Transmit/receive frequency separation

No specific requirements for Tx/Rx –separation.

4.2 Environmental Conditions

The equipment shall be required to meet the environmental conditions set out in ETS 300 019 [3], which defines weather protected and outdoor environmental classes and test severities. The manufacturer shall state which class the equipment is designed to withstand.

4.2.1 Equipment within weather protected locations (indoor locations)

Equipment intended for operation within temperature controlled locations or partially temperature-controlled locations shall meet the requirements of ETS 300 019 [3] classes 3.1 and 3.2 respectively.

Optionally, the more stringent requirements of ETS 300 019 [3] classes 3.3 (non-temperature-controlled locations), 3.4 (sites with heat trap) and 3.5 (sheltered locations) may be applied.

4.2.2 Equipment for non-weather protected locations (outdoor locations)

Equipment intended for operation within non-weather protected locations shall meet the requirements of ETS 300 019 [3], Class 4.1 or 4.1E.

Class 4.1 applies to many European countries and Class 4.1E applies to all European countries.

4.3 Electromagnetic Compatibility

Equipment shall operate under the conditions specified in ETS 300 385 [4].

4.4 Baseband Interface

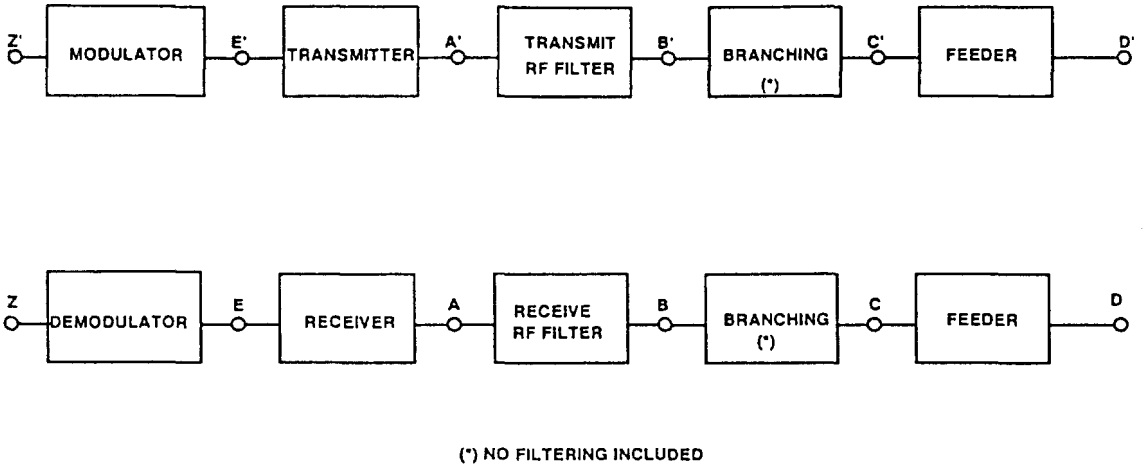
When standard interfaces are provided they shall comply with ITU-T standards recognised by ETSI.

In some applications of these radio relay systems, interface parts may be integrated with other systems and therefore standard interfaces are not required under these circumstances. The manufacturer shall declare whether a standard interface is provided or not.

For conformance testing of Class A equipment, a baseband interface at points Z, Z' of the block diagram in Figure 1 which complies to one of the ETSI recognised standard interfaces (e.g. Rec. ITU-T G.703 [8]) shall be made available.

4.5 System block diagram

The system block diagram is shown in Figure 1.



NOTE 1: For the purpose of defining the measurement points, the branching network does not include a hybrid.
NOTE 2: The points shown above are reference points only; points C and C', D and D' in general coincide.
NOTE 3: Points B and C, B' and C' may coincide when simple duplexer is used.

NOTE 4; In case of TDD systems points B, B´, A and A´ may coincide

Figure 1: System block diagram

4.6 Antennas and RF-interface

4.6.1 Antenna Requirements

Requirements for the co-polar antenna radiation pattern envelope are given Figure 7a) (Range 6, Class 1) in EN 300833 (1999) [15]. However, cross-polar radiation pattern requirements are not relevant for the systems using this frequency band.

4.6.2 RF interface

An adaptor from point D or D´ to IEC standard flange shall be made available by the manufacturer for transmit power, RF-spectrum and spurious emission measurements .

4.7 Power supply

The equipment shall operate from any of the primary supplies within the ranges specified in ETS 300 132-1 [1] and ETS 300 132-2 [2].

NOTE: Some applications may require voltages that are not covered by ETS 300 132-1 [1] and ETS 300 132-2 [2] (e.g. 12 V and / or 24 V).

5 Parameters for digital systems

5.1 Transmission capacity

The manufacturer shall declare the transmission capacities and the channel spacing used. With all transmission capacities the relevant spectrum mask shall be conformed to.

5.2 Error-performance and availability requirements for Class A equipment

Class A equipment shall be designed in order to meet network error-performance and availability requirements foreseen by ITU-T Recommendation G.826 [11], following the criteria defined in ITU-R Recommendations F.1189 [12], F.697 [16] and F.ANPER [7] for the short haul or the access part of the national portion of the digital connection

The interference limit specified in paragraph 4.1.3.2, rather than the actual threshold of the equipment, should be considered, when planning the hop length for the required fade margin due to propagation effects.

It should be noted that the specified channel selection procedure (see clause 4.1.3) can help to avoid interference situations between Class A equipment but cannot guarantee interference–free operation in all situations (see note below).

The frequency agility, described in paragraph 4.1.3.3, may be a useful function in interference avoidance e.g. between systems using different duplexing methods or between class A and class B – systems.

Note: Interference power level in existing network receivers can be in the worst case:

- 71dBm –Ptx (dBm) + 10 log(BW/10MHz),

where:
Ptx is the mean transmit power of the radio relay at the reference point D´ given in the Figure 1,
BW is the noise bandwidth of the receiver.

The interference value calculated from the equation simulates the interference effect of a continuous signal. However, the true effect of a bursty signal may be approximately 3 dB higher (with 50% duty cycle).

5.3 Transmitter characteristics

5.3.1 Transmitter power

5.3.1.1 Transmitter power range

The transmit power shall not exceed –20 dBW referred to point D´ in the system block diagram given in Figure 1. For continuous signals the average power shall be measured. For burst type signals (e.g.TDD) the average power during the signal burst shall be measured.

5.3.1.2 Equivalent Isotropically Radiated Power (EIRP)

The Equivalent Isotropically Radiated Power (EIRP) shall be limited to 15 dBW.

5.3.2 Radiated Spectrum

5.3.2.1 RF spectrum mask

The spectrum mask for 100 MHz radio channels is shown in Figure 2a and for 50 MHz channels in Figure 2b. The RF-frequency instability allowance is not included in the masks. The related spectrum analyser settings are given in Table 1.

Spectrum mask requirement shall be fulfilled with all baseband alternatives applied. In cases of PDH baseband interfaces, the test signal in accordance with ITU-T O.151 shall be used.

Table 1: Spectrum analyzer settings for RF power spectrum measurements

Channel spacing	MHz	100	50
Centre Frequency		Actual	Actual
Sweep width	MHz	250/500	150/250
Scan time	s	5	5
IF bandwidth	kHz	100	100
Video bandwidth	kHz	3	3

5.3.2.2 Spurious emissions

According to ITU-R Recommendation F.1191 [10] and CEPT/ERC Recommendation 74-01 [9], the external spurious emissions are defined as emissions at frequencies which are outside the nominal carrier frequency more than 250% of the relevant channel separation.

The limits of these emissions, which apply at reference point C', shall conform to CEPT/ERC Recommendation 74-01 [9].

5.3.3 Radio frequency tolerance

The maximum allowable RF frequency tolerance from the nominal carrier frequencies shall not exceed ± 50 ppm. This limit includes both short-term factors (environmental effects) and long-term ageing effects. The manufacturer shall declare the values of the nominal carrier frequencies.

In the type test the manufacturer shall state the guaranteed short-term part and the expected ageing part.

5.4 Receiver characteristics

5.4.1 Spurious emissions

Refer to sub-clause 5.3.2.2. Spurious emission requirements shall apply at the reference point C.

6. Parameters for wideband analogue systems

6.1 Transmitter characteristics

6.1.1 Power

6.1.1.1 Transmitter power range

The mean transmit power shall not exceed -20 dBW as referred to point D' in the system block diagram given in Figure 1.

6.1.1.2 EIRP

The Equivalent Isotropically Radiated Power (EIRP) shall be limited to 15 dBW.

6.1.2 Radiated spectrum

6.1.2.1 Spectrum mask

The spectrum masks are shown in Figures 2a and 2b respectively for 100 MHz channels and 50 MHz channels.

The RF-frequency instability allowance is not included in the spectrum masks. The recommended spectrum analyser settings for measuring the RF spectrum mask detailed in Figures 2a and 2b are showed in Table 1.

6.1.2.2 Spurious emissions

Refer to sub-clause 5.3.2.2.

6.1.3 RF frequency tolerance

The maximum allowable RF frequency tolerance shall not exceed. ±200 ppm. This limit includes both short-term factors (environmental effects) and long-term ageing effects. The manufacturer shall declare the values of the nominal carrier frequencies. In the type test the manufacturer shall state the guaranteed short-term part and the expected ageing part.

6.2 Receiver characteristics, spurious emissions

Refer to sub-clause 5.4.1

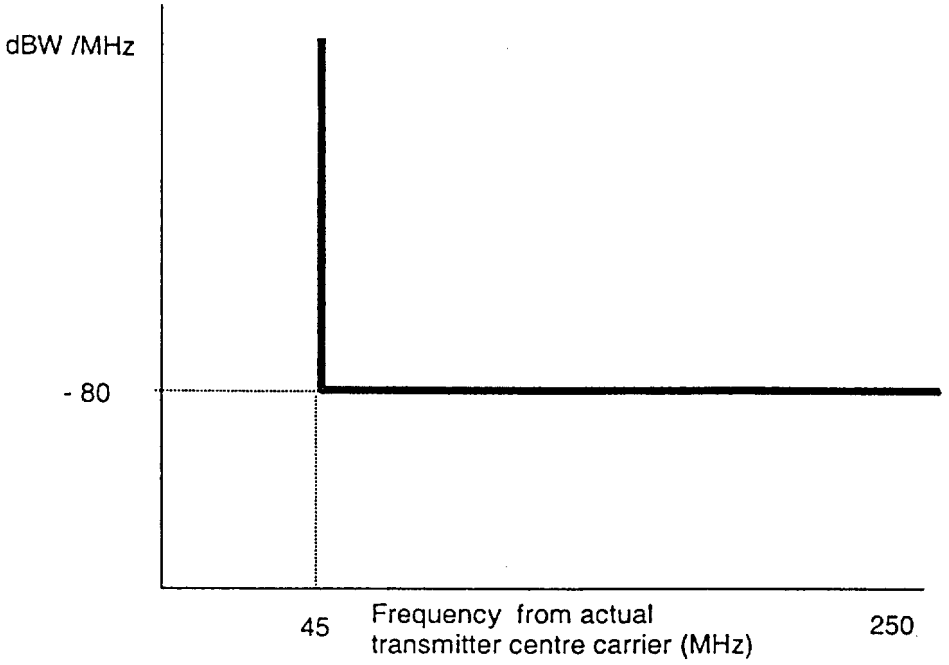


Figure 2a: Limits of spectral power density for 100MHz radio channels

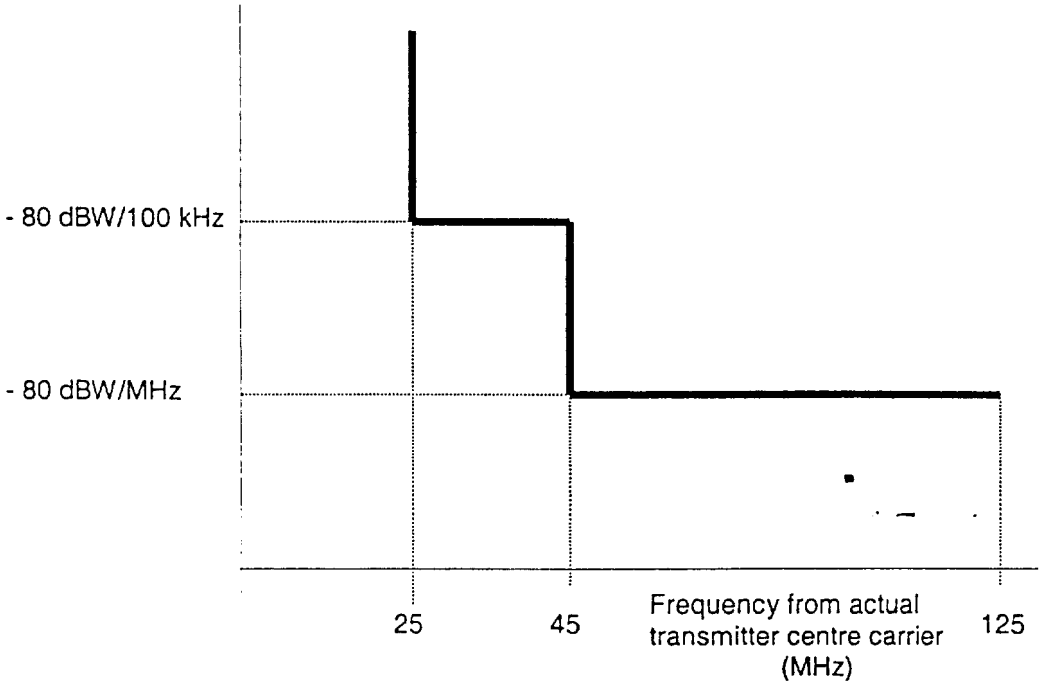


Figure 2b: Limits of spectral power density for 50 MHz radio channels

Annex A (informative): Additional information

A.1 Additional information on Class A and Class B

Class A equipment, with higher performance and availability requirements as referred to in Clause 5.2, cannot share spectrum with Class B equipment using FDD or TDD without a Channel selection procedure-see sub-Clause 4.1.3. Regulators may restrict both classes to their own separately defined sub-bands.

A.2 Radio frequency channel arrangement

The relevant radio frequency channel arrangement provided by CEPT Recommendation T/R 12-09 E [5]; however, for reader's convenience, the figure below gives its general overview:

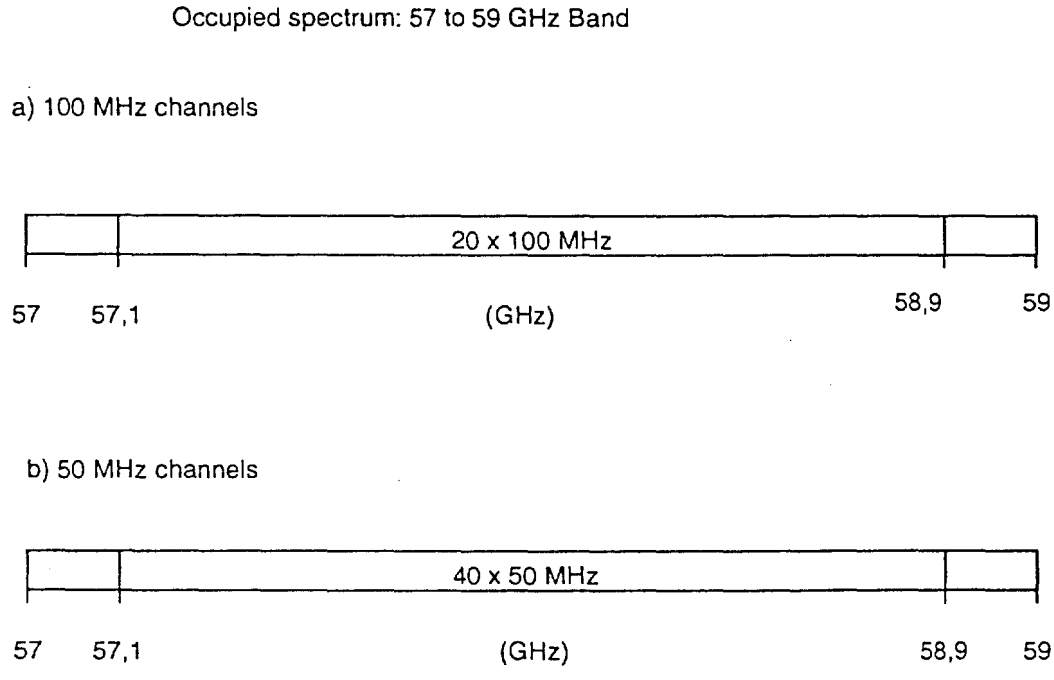


Figure A.2: Radio frequency channel arrangement

Let f_r be the reference frequency of 56 950 MHz,
f_n be the centre frequency of a radio-frequency channel in the band 57 - 59 GHz,

then the centre frequencies of individual channels are expressed by the following relationships:

a) for systems with a channel separation of 100 MHz:

$$f_n = f_r + 100\ n \quad \text{MHz}$$

where:

$n = 1, 2, 3, \ldots\ldots 20$

b) for systems with a channel separation of 50 MHz:

$$f_n = f_r + 25 + 50\ n \quad \text{MHz}$$

where:

$n = 1, 2, 3, \ldots\ldots 40$

Channels within the frequency ranges 57 - 57.100 GHz and 58.900 - 59 GHz should not be used for traffic, until satisfactory coexistence studies with Fixed Service in adjacent bands are completed; these channels could be used for equipment alignment and propagation tests.

A.3 Antenna alignment procedures

The RF-channel selection procedure specified in Clause 4.1.3 requires that new systems should not start to transmit at "occupied" channels. This requirement shall be respected also during the antenna alignment in order to avoid possible interferences to other systems. The following methods could be used for the antenna alignment without disturbing the existing transmission (examples only):

- Use of band edge channels 57-57,1 GHz and 58,9-59 GHz which are dedicated by CEPT/ERC Rec 12-09 for equipment alignment and propagation tests for "normal" antenna alignment procedure.

- Use of optical viewfinder, which is applicable for hops up to about 500 metres. Rough alignment by optical means is always necessary,

- More sophisticated procedures may use, after optical alignment, interference measurement results at both ends and transmit test signal one end at the time using the detected unoccupied channels. Receiving end could sweep the possible channels one by one to detect the signalling tone and use the level of it for the alignment indication. Separate communications means such as mobile phones could also be used to simplify the procedure.

Annex B (Normative): Essential requirements for the EC Council Directive 89/336 (EMC Directive)

The clauses of EN 300 408: " Point-to-point equipment; Parameters for radio systems for the transmission of digital signals and analogue video signals operating at around 58GHz, which do not require co-ordinated frequency planning", reported in Table B1, are relevant for the EC directive [89/336].

Table B.1: Sub-clauses of EN 300 408 relevant for compliance with the essential requirements of the EC Council Directive 89/336

Clause/ sub-clause number, or annex reference	Title	Corresponding article of Council Directive 89/336/EEC	Qualifying remarks
	Spurious emission tests:		
5.3.2 2	Spurious emissions (transmitter, digital systems)	4(a)	
5.4.3	Spurious emissions (receiver, digital systems))	4(a)	
6.2.2.2	Spurious emissions (transmitter, analogue systems)	4(a)	
6.3	Receiver characteristics, spurious emissions (analogue systems)	4(a)	
4.1.3.2	Interference avoidance requirements	4(a)	

Note: During the process of the agreement against the EMC-directive a test shall be provided with the RF-channel selection procedure being into operation to verify that the equipment comply with relevant EMC-requirements.

Annex C (normative): System type codes for regulatory procedures

System types reported in EN 300 408: " Point-to-point equipment; Parameters for radio systems for the transmission of digital signals and analogue video signals operating at around 58GHz, which do not require co-ordinated frequency planning", shall be identified with the codes reported in Table C1

Table C.1: System type codes for radio equipment reported in EN 300 408, relevant to regulatory procedures

System type codes	Equipment class	Channel spacing	System type
01	Class A	50 MHz	Digital
02	Class A	100 MHz	Digital
03	Class B	50 MHz	Digital
04	Class B	100 MHz	Digital
05	Class B	50 MHz	Analogue
06	Class B	100MHz	Analogue

Class A: Digital equipment for high density fixed service (HDFS) applications typically connected to public networks, which apply the RF-channel selection procedure (see paragraph 4.1.3)

Class B: Equipment without requirements for quality of service.

Annex D (informative): Rationale for the interference limit formula

D.1 Analysis of the quality value for the channel selection procedure

D.1.1 Theoretical background

The channel selection procedure targets to ensure required quality of service of 58 GHz radio links connected to public switched networks. The principle of channel selection procedure is that Class A 58 GHz radio links do not start to transmit on a channel when that channel is already in use. This would ensure continued operation of various kinds of radio links.

The channel use can be detected if the received interference power *I* clearly exceeds the noise power. The receiver noise power is given by N_0 NF B where B is the bandwidth of the interference measurement, NF is the noise figure, and N_0=kT. The transmission is allowed when

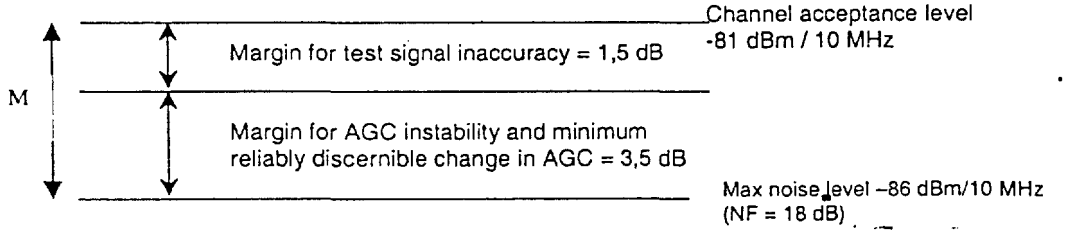
$$I/B < M N_0 NF \qquad (1)$$

where M is the necessary margin and the noise power density NF N_0. A reasonable channel use threshold is, therefore,

$$(I/B)_{threshold} = M N_0 NF. \qquad (2)$$

The suggested threshold value for various kinds of systems is -151 dBm/Hz (-81dBm/10MHz). It can be obtained taking noise figure (NF) 18dB and margin of 5 dB or other combination of the two. This threshold has been agreed as the reference for the interference limit formula in clause 4.1.3.2.1. See figure below for the breakdown of the margin M.

In order to avoid conflict situations, it is necessary that the interference is measured from the whole transmission bandwidth before transmission is initiated.



D.1.2 Analysis of a typical co-channel interference situation when channel rejection threshold is used

The interference level measured by a radio is generally caused by many interfering radios, but in a typical situation one interferer dominates. Therefore, we concentrate on studying the system of two radios belonging to different hops shown in Fig. 1. Radio 0 is transmitting at power P_0 and has signal bandwidth B_0. Its antenna gain in the direction of the interfering radio 1 is $G_0(\theta_0)$. The corresponding values for radio 1 are P_1, B_1, and $G_1(\theta_1)$. The interference power measured in radio 0 on bandwidth B_0, caused by radio 1, is I_0 and the interference power measured by radio 1, caused by radio 0, is I_1.

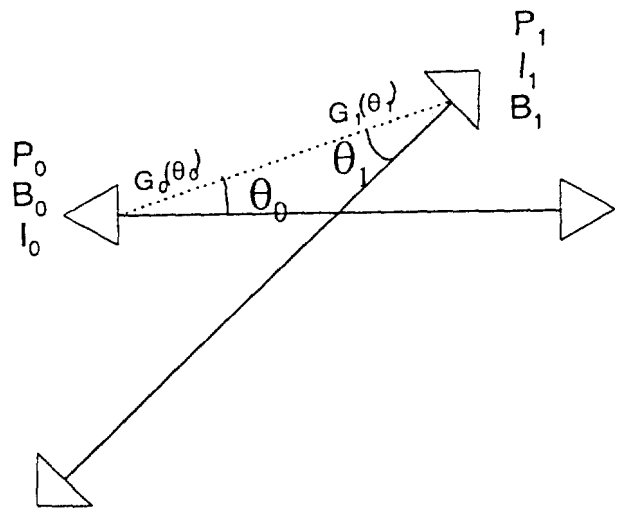


Figure 1. A configuration of two interfering links.

Assuming that receiver bandwidth is approximately equal to transmit signal bandwidth, and assuming that $B_1 > B_0$, we write the interference powers as

$$I_0 = (B_0/B_1)P_1G_0(\theta_0)G_1(\theta_1)A_{12}$$
$$I_1 = P_0G_1(\theta_1)G_0(\theta_0)A_{12}, \quad (3)$$

where A_{12} is the attenuation. On the other hand, if $B_1 < B_0$, we have

$$I_0 = P_1G_0(\theta_0)G_1(\theta_1)A_{12}$$
$$I_1 = (B_1/B_0)P_0G_1(\theta_1)G_0(\theta_0)A_{12}. \quad (4)$$

When the common factors $G_0(\theta_0)$, $G_1(\theta_1)$, and A_{12} are eliminated from the two equations in (3) we get the relation

$$P_1I_1/B_1 = P_0I_0/B_0. \quad (5)$$

The same equation is found if the common factors are eliminated form the two equations in (4). Thus the antenna gains are of no concern.

If the most recently installed radio system 1 asserts the following condition..

$$I_1/B_1 < (I/B)_{threshold} \quad (6)$$

we obtain. by using equation (6). for the interference caused to the previously existing system 0:

$$I_0/B_0 < (P_1/P_0)(I/B)_{threshold} \quad (7)$$

This indicates that the use of the channel selection threshold guarantees that the interference generated to existing radio systems is limited by equation (7).

D.2 Protection capability of the RF-channel selection procedure

Rf-channel selection procedure specifies the maximum interference level of an unoccupied channel which defines the hop length rather than the noise limit. The procedure helps, however, to avoid interference situations between systems with different parameters such as transmit power or spectrum width. The procedure guarantees interference free operation for systems with relatively simple modulation methods typically up to about 500 metres. Longer hops are protected with high probability if the RF-channel with the lowest measured interference power is always selected during the procedure.

The channel selection procedure does not always protect against the adjacent channel interference when there is large difference in out-of-band spectrum of the existing system and the new system and if the distance to the interferer is fairly short.

The interference situations between systems with different duplex methods cannot be always avoided. Interferences from FDD-type systems into TDD-type systems can be avoided if the procedure is applied according to the standard in both systems. However, the procedure cannot guarantee interference free situation for FDD-type systems because duplex-frequency is not standardized. For this reason the concept of "frequency agility" was specified (see Clause 4.1.3.3). This method may also help to avoid long outages due to interference situations between Class A and Class B systems.

D.3. Frequency agility criteria

A means to implement criteria for the detection of unacceptable interference could be the following:

Unacceptable interference situation (corresponding to unavailability situation) is decided if during 10 consecutive seconds or more the estimated BER evaluated by an in-service proprietary method, with a level of confidence of 99%, exceeds 10-3 and the actual received signal level is more than 5 dB above the receiver threshold level corresponding to BER=10-3. For conformance testing purposes this receiver threshold level shall be declared by the manufacturer. If available, the new RF-channel shall be operational again within the time declared by the manufacturer.

History

Document history			
March 1994	Public Enquiry	PE 59:	1994-03-21 to 1994-08-12
July 1995	Vote extended:	V 84:	1995-07-24 to 1995-09-15 1995-07-24 to 1995-09-29
March 1996	First Edition		
November 1998	Draft revision by TM4		
February 1999	Draft rev 4		
June 1999	Draft revision 1999-06-04		
September 1999	Final draft approved by TM4 (AbC) 1999-09-28		